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# FLOOD INSURANCE STUDY

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## TOWN OF GORHAM, NEW HAMPSHIRE
### COOS COUNTY

OCTOBER 1, 1980

federal emergency management agency
federal insurance administration

COMMUNITY NUMBER - 330032

FEMA 1.209-

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PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index

Flood Insurance Rate Map

FLOOD INSURANCE STUDY
TOWN OF GORHAM, NEW HAMPSHIRE

# 1.0 INTRODUCTION

## 1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Town of Gorham, Coos County, New Hampshire, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert Gorham to the regular program of flood insurance by the Federal Insurance Administration (FIA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these federally-supported studies are based. These criteria take precedence over the minimum federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.3. In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

## 1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were prepared by the U. S. Geological Survey for the Federal Insurance Administration, under Inter-Agency Agreement No. IAA-H-9-77, Project Order No. 30. This work was completed in February 1979.

## 1.3 Coordination

Streams requiring detailed study were identified at an initial Consultation and Coordination Officer's (CCO) meeting in January 1976. This meeting was attended by representatives of the U. S. Geological Survey (USGS), the FIA, and the Town of Gorham.

During the course of the study, flood elevations, flood boundaries and floodway delineations were reviewed with community officials. An interim CCO meeting was held in Gorham on February 22, 1979, to review the progress of the study.

On February 4, 1980, the results of the study were reviewed at the final CCO meeting, attended by representatives of the USGS, the FIA and the community.

## 2.0 AREA STUDIED

### 2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Town of Gorham, Coos County, New Hampshire. Included in the study were areas of the White Mountain National Forest and the Moose Brook State Forest. The area of study is shown on the Vicinity Map (Figure 1).

Flooding on the Androscoggin River (including coincident flow on Messenger Brook from its mouth near Dublin Street) was studied in detail along its entire length within the Town of Gorham. The Peabody River, from its confluence with the Androscoggin River to the boundary of the White Mountain National Forest; Moose Brook, from its confluence with the Androscoggin River to the boundary of the Moose Brook State Forest; and the Moose River, from its confluence with the Androscoggin River to the vicinity of Jimtown Road, were also studied by detailed methods. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction for the next five years, through February 1984.

Several streams were studied by approximate methods. Flooding on Tinker Brook and an unnamed brook near Pisani Street was studied by approximate methods from the point at which their respective channels are located at an elevation of about 1,000 feet, to their confluence with the Androscoggin River. Moose Brook, from the boundary of the Moose Brook State Forest to the western corporate limits, and a section of the Moose River, from the vicinity of Jimtown Road to the boundary of the White Mountain National Forest, were also studied by approximate methods.

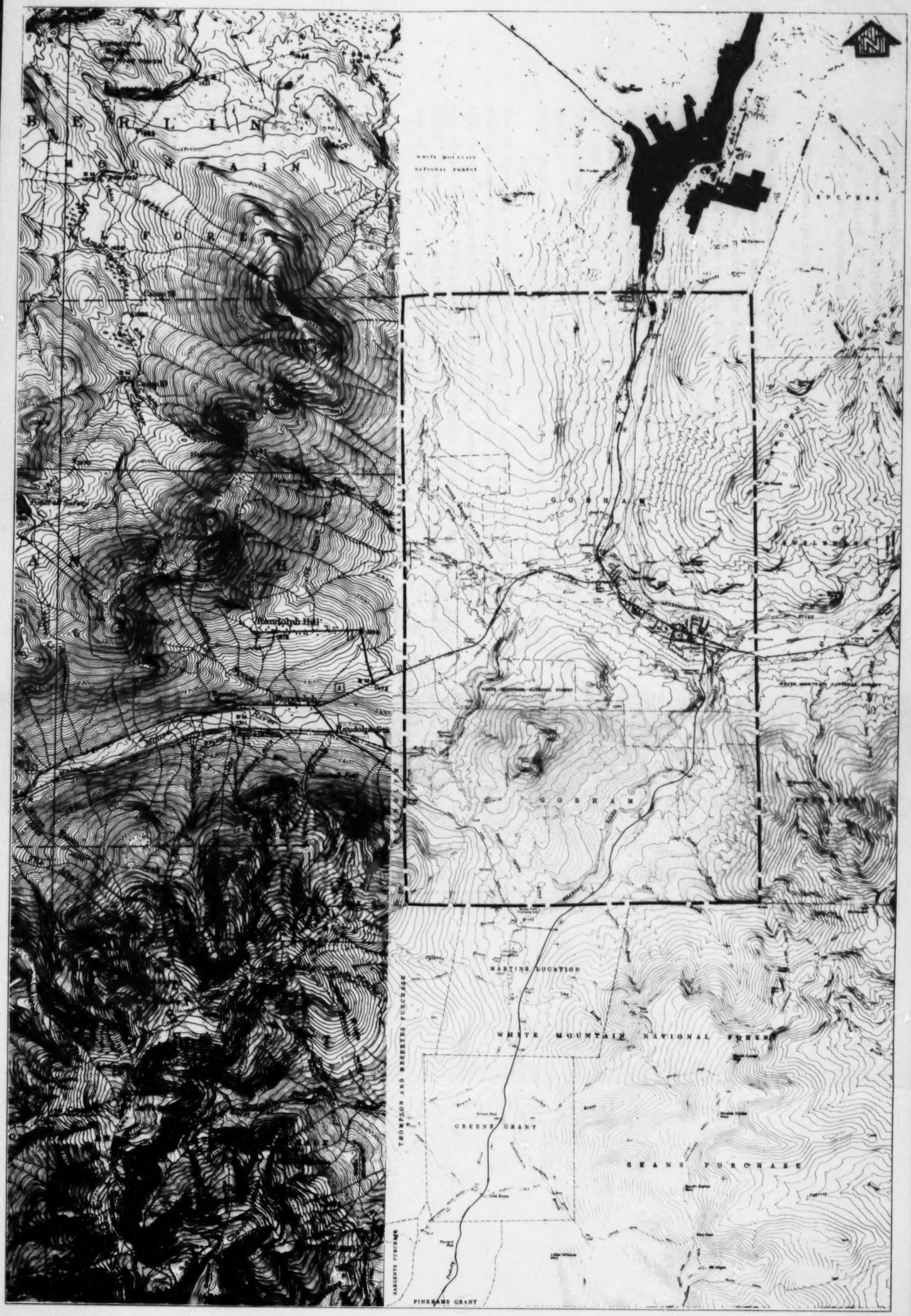

B E R L I N
M O U N T A I N
N A T I O N A L F O R E S T
Randolph Hill
Randolph
G O R H A M
MARTINS LOCATION
WHITE MOUNTAIN NATIONAL FOREST
GREENS GRANT
BEANS PURCHASE
PINKHAMS GRANT
THOMPSON AND MESERVES PURCHASE

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

# TOWN OF GORHAM, NH
(COOS CO.)

APPROXIMATE SCALE
6,000 0 6,000 12,000 18,000 FEET

## VICINITY MAP

Approximate methods of analysis were used to study those areas having low development potential and minimal flood hazards as identified at the initiation of the study. The scope and methods of study were proposed to and agreed upon by the FIA.

## 2.2 Community Description

The Town of Gorham is located in the southeastern portion of Coos County, in northern New Hampshire. Gorham is bordered by the City of Berlin to the north, the unincorporated area of Success to the northeast, the Towns of Shelburne and Randolph to the east and west, respectively, and the unincorporated areas of Beans Purchase, Martins Location, and Thompson and Meserves Purchase to the southeast, south and southwest, respectively. The Town of Gorham is situated approximately 100 miles north of the City of Concord, New Hampshire and 50 miles west of the Town of Rumford, Maine. The population increased from approximately 2,500 in 1950 to about 3,140 in 1977 (Reference 1). The total land area of Gorham is 35.3 square miles, with only five percent developed and the remainder wooded or vacant. About one-third of the Town of Gorham lies within the boundaries of the White Mountain National Forest and the Moose River State Park.

The climate of northern New Hampshire is variable. The average annual precipitation for the Town of Gorham is 38 inches, including 101 inches of snowfall. Average monthly temperatures range from a low of 16 degrees Fahrenheit (°F) in January to a high of 66.5°F in July. Temperature extremes during 80 years of record ranged from a low of -44°F to a high of 100°F (Reference 2).

The Androscoggin River, which flows southeast through the town, is one of the principal rivers in New Hampshire. It originates at the outlet of Umbagog Lake on the Maine-New Hampshire border and flows 161 miles southeast to its outlet in Merrymeeting Bay near the Town of Brunswick, Maine. Its total drainage area is 3,450 square miles. The Androscoggin River flows between the Mahoosuc Mountain Range on the eastern side of the Town of Gorham and the Sugar and Mount Washington Ranges to the west. Development within the Androscoggin River flood plain consists of both single and multi-family residences and one large pulp and paper mill located at Cascade Flats. This mill is a division of the Brown Paper Company of Berlin, New Hampshire.

The Peabody and Moose Rivers are tributaries which flow east to the Androscoggin River. They have slopes of 137 and 135 feet per mile, with drainage areas of 46.6 and 23.9 square miles, respectively. Moose Brook, another tributary which flows east to the Androscoggin River, has a slope of 303 feet per mile, and a drainage area of 13.7 square miles.

Except for the settlement at Cascade Flats, most of the development in Gorham is located in the southern section of the town. The developed areas are known as the Upper Village (located between the confluence of the Moose River and Moose Brook with the Androscoggin River) and the Lower Village (located near the mouth of the Peabody River). Development in the Town of Gorham is mainly residential, however motels and restaurants exist in Gorham to accomodate tourists who come to the area to see the surrounding mountain ranges, which include the highest peaks in New England. There is no development on the east bank of the Androscoggin River, an area accessible only by railroad.

## 2.3 Principal Flood Problems

Severe floods occurred on the Androscoggin River within the Town of Gorham in 1826, 1869, 1896, 1927, and 1936. During the flood of October 1869 (known as "the pumpkin freshet") two men were killed when a mill was swept away. The November 1927 flood on the Androscoggin River caused damage in the Town of Gorham/Town of Berlin area (Reference 3). The highest flood recorded since 1929 at the Gorham gaging station was 19,900 cubic feet per second (cfs), recorded during the flood of March 1936 (Reference 4). A flood of that magnitude has a recurrence interval of 50 years, however, under present hydraulic conditions, the water-surface elevation of a 50-year flood in Gorham would be lower than that of the 1936 flood. Discharges of 20,000 cfs (determined by computations of flow over dams and through wheels and gates located approximately 3 miles above the Gorham gage) occurred on June 18, 1917, and April 30, 1923.

## 2.4 Flood Protection Measures

A number of dams and lakes located in the headwaters of the Androscoggin River can store significant amounts of runoff, thereby reducing peak flow intensity. For example, during the flood of March 1936, six lakes about 35 miles upstream from the Town of Gorham stored more than 16 billion cubic feet of floodwater, equivalent to 75 percent of the total possible flood runoff from the drainage area of 1,095 square miles (Reference 5).

Non-structural measures of flood protection are also being utilized to aid in the prevention of future flood damage. These are in the form of land-use regulations which control building within areas that have a high risk of flooding.

## 3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one-percent chance of annual occurrence) in any 50-year period is about 40 percent (four in ten) and, for any 90-year period, the risk increases to about 60 percent (six in ten). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

### 3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail affecting the community.

Discharge values for the Androscoggin River at the Town of Gorham/Town of Berlin corporate limits were obtained from USGS gaging station No. 01054000, located at the Town of Gorham, New Hampshire. This gage is less than 1.0 mile from the corporate limits and has been in operation since 1929. Discharge values for the Androscoggin River, downstream to the Town of Gorham/Town of Shelburne corporate limits, were prorated on the basis of drainage area, considering the discharge values at the next downstream gaging station, USGS gage No. 01054500, located at the Town of Rumford, Maine. This gage has been in continuous operation since 1892. The analyses of the data taken from these gages followed the standard log-Pearson Type III method (Reference 6).

For the Peabody River, the Moose River and Moose Brook, a regional analysis was made to establish the discharges at the selected recurrence intervals. Values of the 10-, 50-, 100-, and 500-year peak

discharges for these streams were based on the relationship between slope and runoff, expressed in cubic feet per square mile. This relationship was established for selected floods at 20 USGS gaging sites in the area. The discharges obtained agree with these determined using a method developed by the USGS for estimating flood frequencies in Maine (Reference 7). This method was utilized because the topography and stream characteristics of this section of New Hampshire are similar to those of western Maine.

A summary of drainage area-peak discharge relationships for the streams studied by detailed methods is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

| FLOODING SOURCE AND LOCATION | DRAINAGE AREA (sq. miles) | PEAK DISCHARGES (cfs) 10-YEAR | 50-YEAR | 100-YEAR | 500-YEAR |
|---|---|---|---|---|---|
| ANDROSCOGGIN RIVER | | | | | |
| At corporate limits | 1,461 | 20,000 | 26,000 | 29,000 | 36,000 |
| Below confluence of the Moose River | 1,410 | 18,000 | 23,000 | 25,000 | 31,000 |
| Above confluence of the Moose River | 1,380 | 17,000 | 22,000 | 24,000 | 28,000 |
| Above confluence of Moose Brook | 1,363 | 15,600 | 19,400 | 21,000 | 24,700 |
| PEABODY RIVER | | | | | |
| At confluence with the Androscoggin River | 46.6 | 4,900 | 8,400 | 11,000 | 16,500 |
| MOOSE RIVER | | | | | |
| At confluence with the Androscoggin River | 23.9 | 2,500 | 4,300 | 5,700 | 8,500 |
| MOOSE BROOK | | | | | |
| At confluence with the Androscoggin River | 13.7 | 2,200 | 4,000 | 5,200 | 7,800 |

### 3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in detail were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of these flooding sources.

Cross-section data for the streams studied by detailed methods were obtained by field survey. All bridges, culverts and dams were surveyed in order to obtain elevation data and structural geometry.

Water-surface elevations for floods of the selected recurrence intervals were computed through use of the USGS E431 step-backwater computer program (Reference 8).

Starting water-surface elevations for the Androscoggin River were calculated using flow-over-dam ratings. A relationship curve between stages and discharges was made for each dam. The discharge over the dam was based on information regarding the flash boards and the operations of the dam, and on the assumption that the diversion through each powerplant was the maximum possible. These ratings were extended on the basis of the standard flow-over-dam formula (Reference 9):

$$Q = CLH^{3/2}$$

where "Q" is the discharge being studied, "C" is the coefficient of the discharge, "L" is the length of the dam perpendicular to the direction of the flow, and "H" is the head on the dam.

The measurements of flow used to obtain values of "C" did not differentiate the flow for leakage or flow through deep gates. The coefficient of discharge was also determined using the tables and graphs found in a USGS publication (Reference 10) which lists "C" values for various dam types. This procedure was utilized for the Shelburne Hydrostation, located downstream of the Town of Gorham/ Town of Shelburne corporate limits; the Cascade Power Station, and the Cascade Hydrostation.

Starting elevations for the Moose River, Moose Brook and the Peabody River were determined using slope-conveyance techniques.

For some floods at the Cascade Power Station Dam and the Cascade Hydrostation Dam, the water-surface elevation before the flashboards go out is higher than the elevation at the time of peak discharge. The higher elevations in these cases have been used as the minimum starting elevations.

Channel roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment, based on field observations of the flooding sources and flood plain areas. Roughness values for the main channel of the Androscoggin River range from 0.030 to 0.065, with the overbank roughness values ranging from 0.035 to 0.100 for all floods. Roughness values for the main channel of the Peabody River range from 0.030 to 0.060, and the overbank roughness values range from 0.045 to 0.090. Roughness values for

the main channel of the Moose River range from 0.035 to 0.065, with the overbank roughness values ranging from 0.055 to 1.00. Roughness values for the main channel of Moose Brook range from 0.035 to 0.060, and the overbank "n" values range from 0.030 to 0.075.

The acceptability of all assumed hydraulic factors, cross sections and hydraulic-structure data was checked through computations duplicating historic flood-water profiles.

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals. Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway is computed (Section 4.2), selected cross-section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

All elevations used in this study are referenced to the National Geodetic Vertical Datum of 1929 (NGVD), formerly referred to as Sea Level Datum of 1929. Locations of the elevation reference marks used in the study are shown on the maps.

The hydraulic analyses for this study are based on the effects of unobstructed flow. The flood elevations shown on the profiles are valid only if hydraulic structures remain unobstructed, and dams and other flood control structures operate properly and do not fail.

Approximate flood elevations were determined using a regional stage-frequency relationship developed by the Augusta, Maine Subdistrict Office of the USGS (Reference 11). In this method, a 10-foot rise over the mapped stream elevation is estimated and used as the inundation limit of the 100-year flood.

## 4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

### 4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FIA as the base

flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100- and 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:4,800, reduced from a scale of 1:2,400, and 1:4,800, reduced from a scale of 1:1,200, with contour intervals of 5 feet and 2 feet, respectively (References 12 and 13). In cases where the 100- and 500-year flood boundaries are close together, only the 100-year boundary has been shown.

For the streams studied by approximate methods, the 100-year flood boundaries were delineated using a regional stage-frequency relationship developed by the USGS (Reference 11). For the portion of Moose Brook studied by approximate methods, the 100-year flood boundary was delineated using a USGS topographic map at a scale of 1:24,000, enlarged to a scale of 1:12,000, with a contour interval of 20 feet (Reference 14).

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 2). Small areas within the flood boundaries may lie above the flood elevations and, therefore, may not be subject to flooding. Owing to limitations of the map scale and lack of detailed topographic data, such areas are not shown.

## 4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood can be carried without substantial increases in flood heights. Minimum standards of the FIA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this report are presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plains. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 2).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

Floodwaters from the Moose River were found to have hazardous velocities. Encroachment into areas subject to inundation by floodwaters having hazardous velocities aggravates the risk of flood damage, and heightens potential flood hazards by further increasing velocities. To provide guidance for encroachment into these areas, a proposed floodway is delineated for that part of the 100-year flood plain that conveys flow.

## 5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FIA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHFs), and flood insurance zone designations for each flooding source affecting the Town of Gorham.

| FLOODING SOURCE | | FLOODWAY | | | BASE FLOOD WATER SURFACE ELEVATION | | | |
|---|---|---|---|---|---|---|---|---|
| CROSS SECTION | DISTANCE[1] | WIDTH (FT.) | SECTION AREA (SQ. FT.) | MEAN VELOCITY (F.P.S.) | REGULATORY (NGVD) | WITHOUT FLOODWAY (NGVD) | WITH FLOODWAY (NGVD) | INCREASE (FEET) |
| Androscoggin River | | | | | | | | |
| A | 550 | 245 | 2,138 | 11.69 | 758.6 | 758.6 | 759.3 | 0.7 |
| B | 1,850 | 300 | 2,194 | 11.39 | 767.9 | 767.9 | 767.9 | 0.0 |
| C | 2,150 | 260 | 4,058 | 6.16 | 774.7 | 774.7 | 775.3 | 0.6 |
| D | 3,350 | 250 | 2,716 | 9.20 | 776.9 | 776.9 | 777.0 | 0.1 |
| E | 4,500 | 260 | 3,371 | 7.42 | 780.4 | 780.4 | 780.4 | 0.0 |
| F | 5,850 | 830 | 7,348 | 3.40 | 782.6 | 782.6 | 782.6 | 0.0 |
| G | 7,050 | 670 | 4,395 | 5.69 | 783.8 | 783.8 | 783.8 | 0.0 |
| H | 8,250 | 210 | 2,605 | 9.60 | 786.0 | 786.0 | 786.0 | 0.0 |
| I | 9,650 | 220 | 2,784 | 8.62 | 789.7 | 789.7 | 789.8 | 0.1 |
| J | 11,200 | 210 | 2,780 | 7.73 | 792.4 | 792.4 | 792.7 | 0.3 |
| K | 12,650 | 210 | 2,430 | 7.60 | 795.2 | 795.2 | 795.4 | 0.2 |
| L | 12,883 | 220 | 2,630 | 7.04 | 795.7 | 795.7 | 795.9 | 0.2 |
| M | 14,400 | 220 | 2,380 | 7.77 | 798.5 | 798.5 | 798.7 | 0.2 |
| N | 15,250 | 535 | 6,925 | 3.03 | 814.9 | 814.9 | 815.5 | 0.6 |
| O | 16,950 | 440 | 5,336 | 3.94 | 815.4 | 815.4 | 816.0 | 0.6 |
| P | 18,100 | 440 | 5,205 | 4.03 | 816.2 | 816.2 | 816.6 | 0.4 |
| Q | 19,500 | 270 | 2,940 | 7.14 | 817.6 | 817.6 | 817.8 | 0.2 |
| R | 20,700 | 240 | 2,493 | 8.42 | 821.1 | 821.1 | 821.1 | 0.0 |

[1] Feet above corporate limits

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

**TOWN OF GORHAM, NH**
(COOS CO.)

**FLOODWAY DATA**

**ANDROSCOGGIN RIVER**

| FLOODING SOURCE | | FLOODWAY | | | BASE FLOOD WATER SURFACE ELEVATION | | | |
|---|---|---|---|---|---|---|---|---|
| CROSS SECTION | DISTANCE[1] | WIDTH (FT.) | SECTION AREA (SQ. FT.) | MEAN VELOCITY (F.P.S.) | REGULATORY (NGVD) | WITHOUT FLOODWAY (NGVD) | WITH FLOODWAY (NGVD) | INCREASE (FEET) |
| Androscoggin River (continued) | | | | | | | | |
| S | 21,900 | 240 | 2,419 | 8.68 | 825.9 | 825.9 | 825.9 | 0.0 |
| T | 23,200 | 290 | 2,675 | 7.85 | 831.1 | 831.1 | 831.1 | 0.0 |
| U | 24,000 | 250 | 2,340 | 8.97 | 834.8 | 834.8 | 834.8 | 0.0 |
| V | 25,000 | 315 | 2,746 | 7.65 | 840.6 | 840.6 | 840.6 | 0.0 |
| W | 26,150 | 235 | 2,754 | 7.62 | 845.8 | 845.8 | 845.8 | 0.0 |
| X | 27,500 | 235 | 2,977 | 7.05 | 850.6 | 850.6 | 850.6 | 0.0 |
| Y | 28,800 | 200 | 2,598 | 8.08 | 854.7 | 854.7 | 854.8 | 0.1 |
| Z | 30,300 | 145 | 2,078 | 10.11 | 861.8 | 861.8 | 862.1 | 0.3 |
| AA | 30,900 | 380 | 3,124 | 6.72 | 903.7 | 903.7 | 903.8 | 0.1 |
| Peabody River | | | | | | | | |
| A | 480 | 145 | 1,115 | 9.86 | 762.8 | 762.8 | 763.8 | 1.0 |
| B | 1,350 | 100 | 991 | 11.10 | 767.9 | 767.9 | 768.8 | 0.9 |
| C | 2,270 | 110 | 835 | 13.17 | 775.8 | 775.8 | 776.1 | 0.3 |
| D | 2,410 | 110 | 857 | 12.83 | 777.6 | 777.6 | 777.9 | 0.3 |
| E | 2,580 | 110 | 802 | 13.71 | 780.0 | 780.0 | 780.0 | 0.0 |
| F | 3,440 | 100 | 829 | 13.28 | 791.0 | 791.0 | 791.0 | 0.0 |

[1] Feet above corporate limits

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

**TOWN OF GORHAM, NH**
(COOS CO.)

**FLOODWAY DATA**

**ANDROSCOGGIN RIVER AND PEABODY RIVER**

| FLOODING SOURCE | | FLOODWAY | | | BASE FLOOD WATER SURFACE ELEVATION | | | |
|---|---|---|---|---|---|---|---|---|
| CROSS SECTION | DISTANCE | WIDTH (FT.) | SECTION AREA (SQ. FT.) | MEAN VELOCITY (F.P.S.) | REGULATORY (NGVD) | WITHOUT FLOODWAY (NGVD) | WITH FLOODWAY (NGVD) | INCREASE (FEET) |
| Peabody River (continued) | | | | | | | | |
| G | 3,610[1] | 100 | 1,088 | 10.11 | 793.5 | 793.5 | 793.5 | 0.0 |
| H | 3,790[1] | 130 | 786 | 14.00 | 794.4 | 794.4 | 794.7 | 0.3 |
| I | 4,900[1] | 80 | 869 | 12.65 | 812.0 | 812.0 | 812.5 | 0.5 |
| J | 6,280[1] | 100 | 692 | 15.90 | 838.8 | 838.8 | 838.8 | 0.0 |
| K | 7,600[1] | 120 | 1,089 | 10.10 | 864.4 | 864.4 | 865.2 | 0.8 |
| L | 8,500[1] | 120 | 928 | 11.86 | 876.6 | 876.6 | 876.6 | 0.0 |
| M | 9,500[1] | 180 | 1,279 | 8.60 | 889.7 | 889.7 | 890.3 | 0.6 |
| Moose Brook | | | | | | | | |
| A | 220[2] | 60 | 450 | 11.57 | 796.0 | 796.0 | 797.0 | 1.0 |
| B | 655[2] | 60 | 476 | 10.92 | 800.4 | 800.4 | 801.2 | 0.8 |
| C | 840[2] | 100 | 527 | 9.87 | 804.7 | 804.7 | 804.8 | 0.1 |
| D | 900[2] | 150 | 948 | 5.49 | 811.0 | 811.0 | 811.0 | 0.0 |
| E | 1,860[2] | 65 | 378 | 13.74 | 826.6 | 826.6 | 826.6 | 0.0 |
| F | 1,895[2] | 130 | 786 | 6.62 | 830.9 | 830.9 | 830.9 | 0.0 |
| G | 2,320[2] | 140 | 566 | 9.18 | 831.9 | 831.9 | 832.9 | 1.0 |
| H | 2,540[2] | 135 | 586 | 8.87 | 840.8 | 840.8 | 840.8 | 0.0 |
| I | 3,180[2] | 130 | 724 | 7.18 | 848.9 | 848.9 | 849.9 | 1.0 |

[1] Feet above corporate limits
[2] Feet above confluence with the Androscoggin River

| FLOODING SOURCE | | FLOODWAY | | | BASE FLOOD WATER SURFACE ELEVATION | | | |
|---|---|---|---|---|---|---|---|---|
| CROSS SECTION | DISTANCE[1] | WIDTH (FT.) | SECTION AREA (SQ. FT.) | MEAN VELOCITY (F.P.S.) | REGULATORY (NGVD) | WITHOUT FLOODWAY (NGVD) | WITH FLOODWAY (NGVD) | INCREASE (FEET) |
| Moose Brook (continued) | | | | | | | | |
| J | 3,700 | 100 | 512 | 10.15 | 859.1 | 859.1 | 859.1 | 0.0 |
| K | 3,760 | 115 | 525 | 9.90 | 862.4 | 862.4 | 862.4 | 0.0 |
| L | 4,900 | 110 | 594 | 8.75 | 880.7 | 880.7 | 881.7 | 1.0 |
| M | 5,750 | 100 | 464 | 11.21 | 897.7 | 897.7 | 897.7 | 0.0 |
| N | 7,070 | 100 | 762 | 6.83 | 913.0 | 913.0 | 913.8 | 0.8 |
| Moose River | | | | | | | | |
| A | 1,270 | 161 | 552 | 10.3 | 791.7 | 791.7 | 791.7 | 0.0 |
| B | 1,880 | 212 | 579 | 9.85 | 801.5 | 801.5 | 801.5 | 0.0 |
| C | 2,000 | 536 | 869 | 6.56 | 804.1 | 804.1 | 804.1 | 0.0 |
| D | 2,090 | 73 | 527 | 10.8 | 804.1 | 804.1 | 804.1 | 0.0 |
| E | 2,170 | 916 | 3,890 | 1.46 | 810.2 | 810.2 | 810.2 | 0.0 |
| F | 2,410 | 759 | 3,620 | 1.58 | 810.3 | 810.3 | 810.3 | 0.0 |
| G | 2,610 | 830 | 1,200 | 4.77 | 810.3 | 810.3 | 810.3 | 0.0 |
| H | 2,950 | 611 | 1,550 | 3.68 | 814.3 | 814.3 | 814.3 | 0.0 |
| I | 3,180 | 111 | 482 | 11.8 | 817.7 | 817.7 | 817.7 | 0.0 |
| J | 3,520 | 545 | 1,770 | 3.23 | 823.0 | 823.0 | 823.0 | 0.0 |
| K | 4,400 | 86 | 444 | 12.8 | 831.7 | 831.7 | 831.7 | 0.0 |

[1] Feet above confluence with the Androscoggin River

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

**TOWN OF GORHAM, NH**
(COOS CO.)

**FLOODWAY DATA**

**MOOSE BROOK AND MOOSE RIVER**

| FLOODING SOURCE | | FLOODWAY | | | BASE FLOOD WATER SURFACE ELEVATION | | | |
|---|---|---|---|---|---|---|---|---|
| CROSS SECTION | DISTANCE[1] | WIDTH (FT.) | SECTION AREA (SQ. FT.) | MEAN VELOCITY (F.P.S.) | REGULATORY (NGVD) | WITHOUT FLOODWAY (NGVD) | WITH FLOODWAY (NGVD) | INCREASE (FEET) |
| Moose River (continued) | | | | | | | | |
| L | 5,880 | 1,021 | 1,100 | 5.16 | 855.4 | 855.4 | 855.4 | 0.0 |
| M | 7,440 | 178 | 632 | 9.01 | 887.3 | 887.3 | 887.3 | 0.0 |
| N | 8,960 | 388 | 1,150 | 4.94 | 910.1 | 910.1 | 910.1 | 0.0 |

[1] Feet above confluence with the Androscoggin River

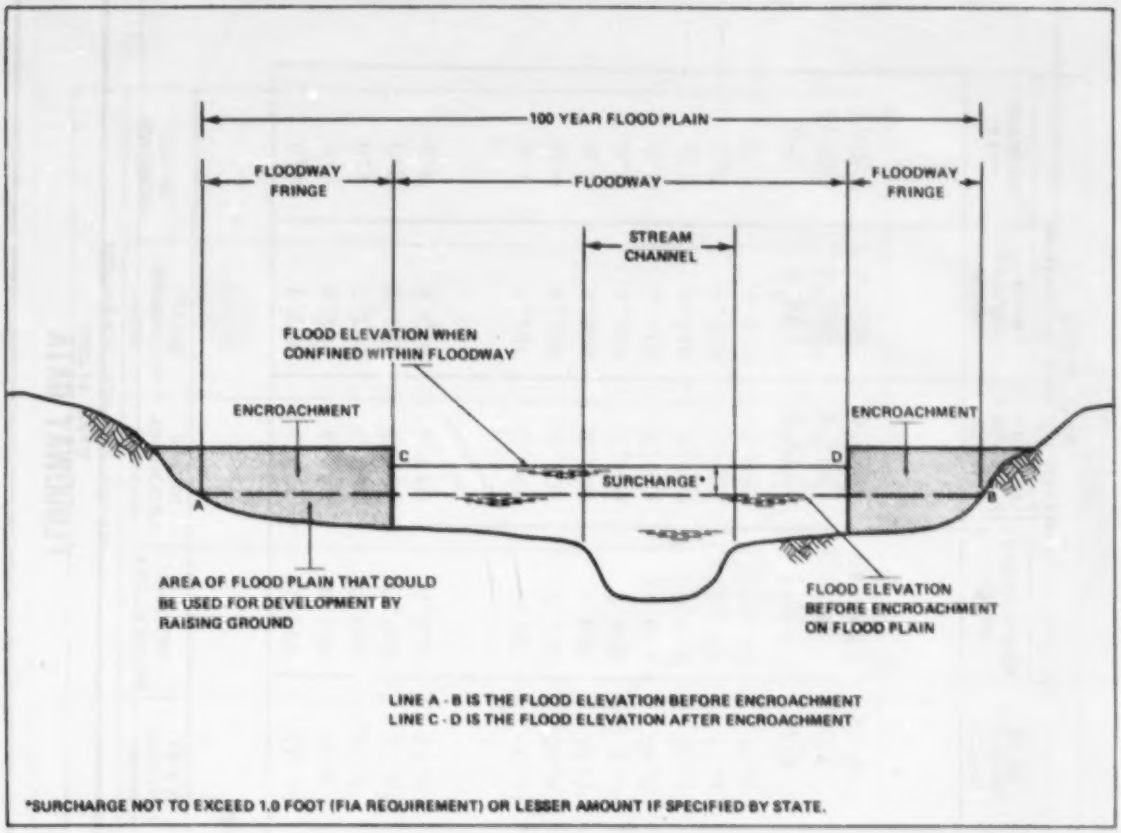
TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

**TOWN OF GORHAM, NH**
(COOS CO.)

**FLOODWAY DATA**

**MOOSE RIVER**


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FIA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

**FLOODWAY SCHEMATIC** Figure 2

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

| Average Difference Between 10- and 100-Year Floods | Variation |
|---|---|
| Less than 2 feet | 0.5 foot |
| 2 to 7 feet | 1.0 foot |
| 7.1 to 12 feet | 2.0 feet |
| More than 12 feet | 3.0 feet |

The locations of the reaches determined for the flooding sources of the Town of Gorham are shown on the Flood Profiles (Exhibit 1) and are summarized in the Flood Insurance Zone Data Table (Table 3).

## 5.2 Flood Hazard Factors

The FHF is the FIA device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest 0.5 foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

## 5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of the Town of Gorham was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

| | |
|---|---|
| Zone A: | Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined. |
| Zones A3, A4, A5, A6, A12: | Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to FHF. |
| Zone B: | Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; also, areas subject to certain types of 100-year shallow flooding where |

| FLOODING SOURCE | PANEL[1] | ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND | | | FHF | ZONE | BASE FLOOD ELEVATION[3] (NGVD) |
|---|---|---|---|---|---|---|---|
| | | 10% (10 YR.) | 2% (50 YR.) | 0.2% (500 YR.) | | | |
| Androscoggin River | | | | | | | |
| Reach 1 | 05,10 | -1.7 | -0.5 | +1.3 | 015 | A3 | Varies |
| Peabody River | | | | | | | |
| Reach 1 | 10 | -2.0 | -0.8 | +1.3 | 020 | A4 | Varies |
| Reach 2 | 10 | -3.1 | -1.5 | +1.5 | 030 | A6 | Varies |
| Moose Brook | | | | | | | |
| Reach 1 | 10 | -2.5 | -0.8 | +1.6 | 025 | A5 | Varies |
| Reach 2 | 10 | -5.8 | -1.4 | +3.6 | 060 | A12 | Varies |
| Reach 3 | 10 | -2.4 | -0.7 | +1.5 | 025 | A5 | Varies |
| Moose River | | | | | | | |
| Reach 1 | 10 | -2.6 | -1.2 | +1.2 | 025 | A5 | Varies |

[1]Flood Insurance Rate Map Panel
[2]Weighted average
[3]Rounded to the nearest foot - see map

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

**TOWN OF GORHAM, NH**
(COOS CO.)

**FLOOD INSURANCE ZONE DATA**

**ANDROSCOGGIN RIVER, PEABODY RIVER, MOOSE BROOK AND MOOSE RIVER**

Zone B: (continued) depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.

Zone C: Areas of minimal flooding.

Zone D: Areas of undetermined but possible flood hazard.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevations for the flooding sources studied in detail in the town.

### 5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Town of Gorham is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FIA.

## 6.0 OTHER STUDIES

The USGS is presently conducting a Flood Insurance Study for the City of Berlin, Coos County, New Hampshire (Reference 15). The results of this Flood Insurance Study will agree with those of the USGS study.

This study is authoritative for purposes of the Flood Insurance Program, and the data presented here either supersede or are compatible with previous determinations.

## 7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the office of the Insurance and Mitigation Division of the Federal Emergency Management Agency, Regional Director, Region I Office, J. W. McCormack Post Office and Courthouse Building, Room 462, Boston, Massachusetts 02109.

## 8.0 BIBLIOGRAPHY AND REFERENCES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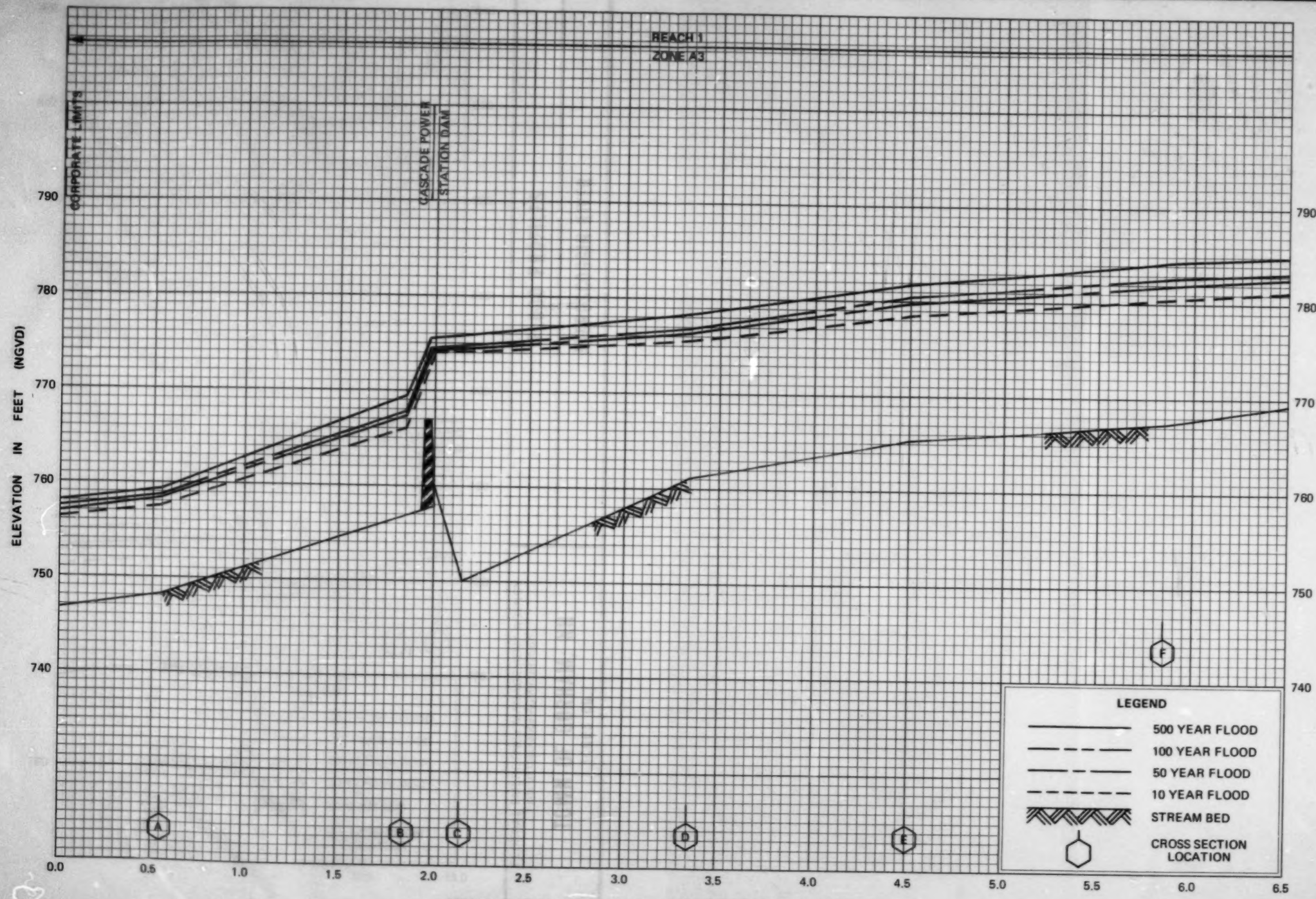


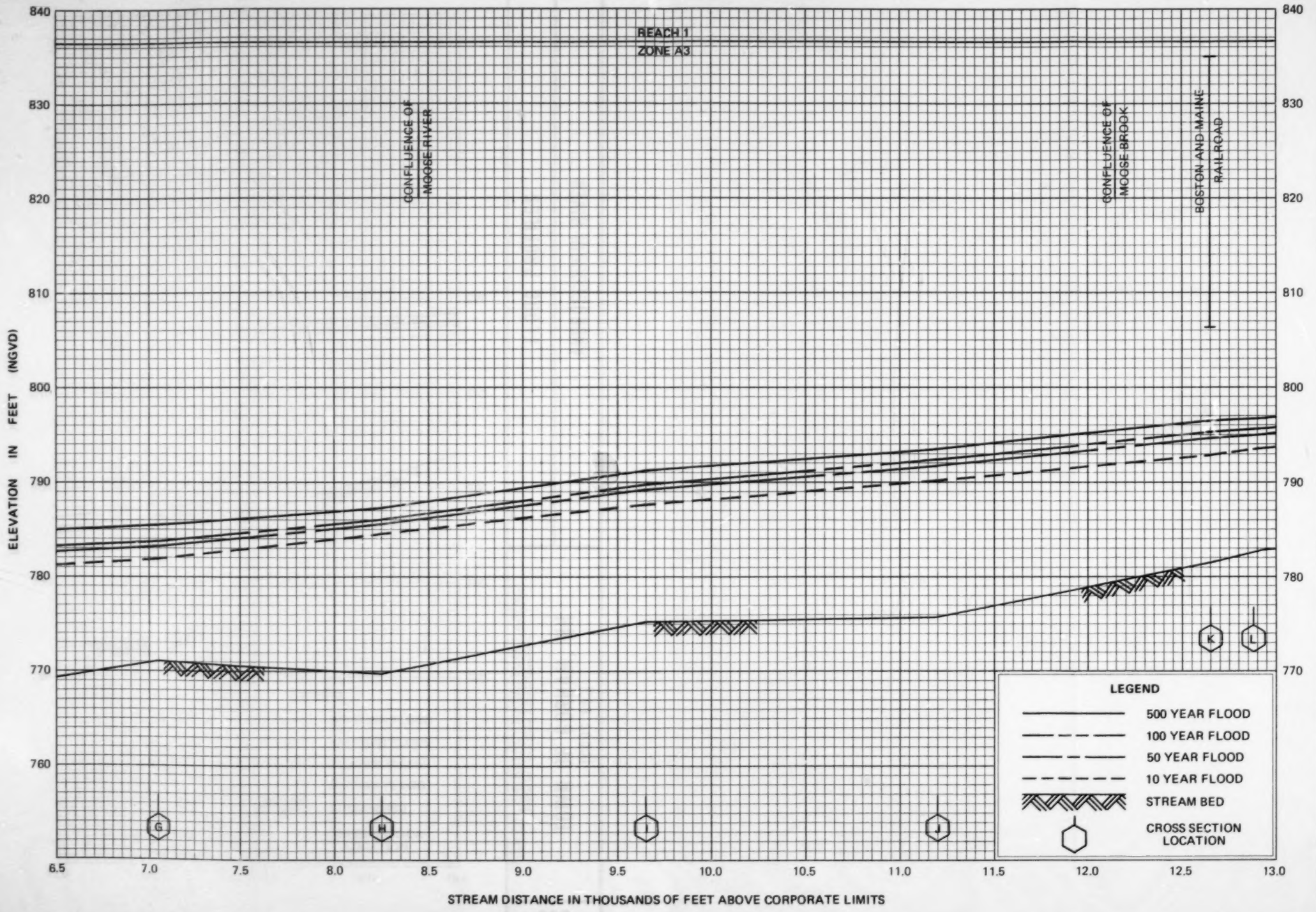

FLOOD PROFILES

ANDROSCOGGIN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWN OF GORHAM, NH
(COOS CO.)

01P



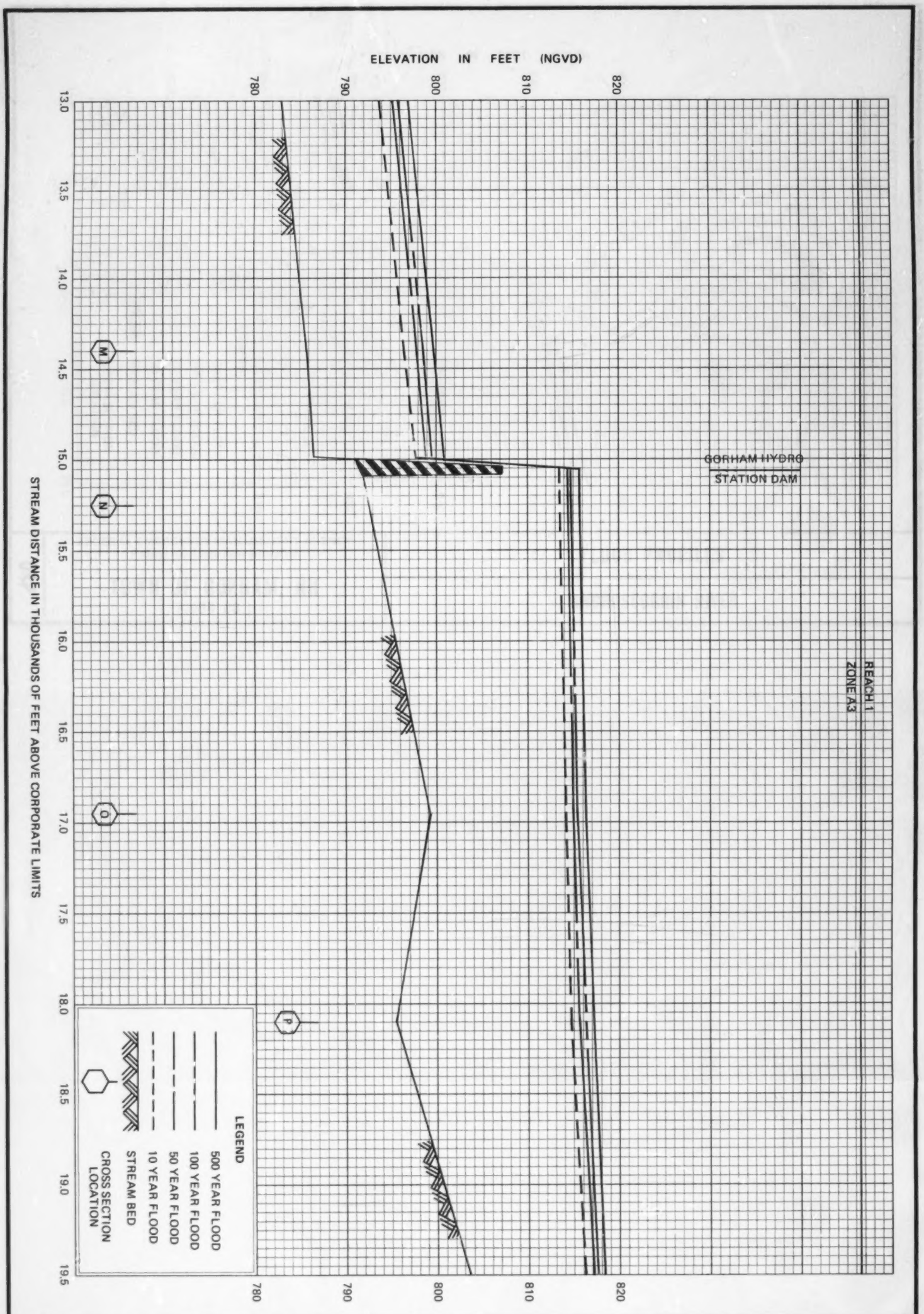

FLOOD PROFILES

ANDROSCOGGIN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWN OF GORHAM, NH
(COOS CO.)

02P

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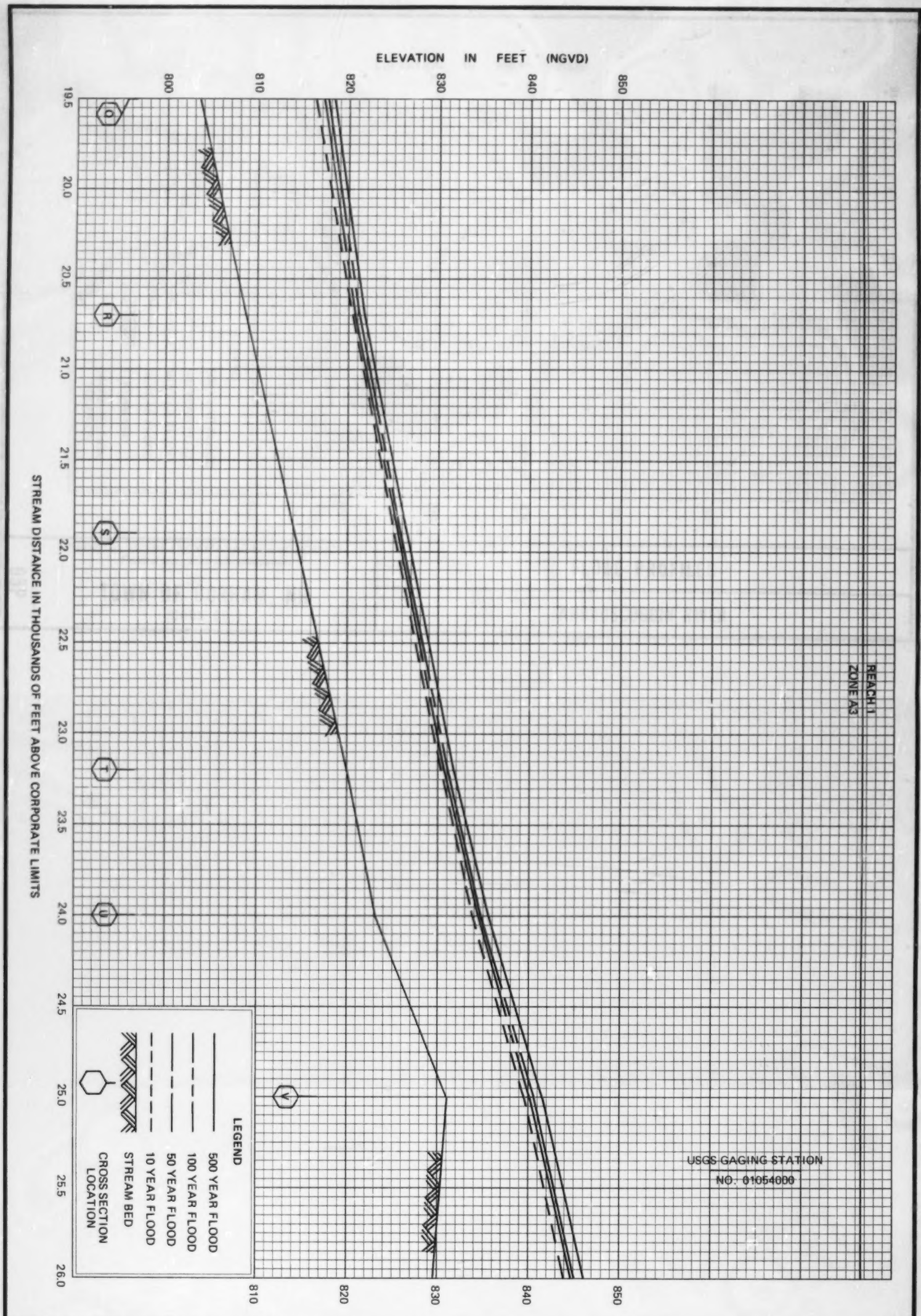
FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

**TOWN OF GORHAM, NH**
(COOS CO.)

**FLOOD PROFILES**

**ANDROSCOGGIN RIVER**

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FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

**TOWN OF GORHAM, NH**
(COOS CO.)

**FLOOD PROFILES**

**ANDROSCOGGIN RIVER**

REACH 1
ZONE A3

ELEVATION IN FEET (NGVD)

910
900
890
880
870
860
850
840
830
820

26.0 26.5 27.0 27.5 28.0 28.5 29.0 29.5 30.0 30.5 31.0

STREAM DISTANCE IN THOUSANDS OF FEET ABOVE CORPORATE LIMITS

CASCADE HYDRO STATION DAM

CORPORATE LIMITS

W X Y Z AA

LEGEND

- 500 YEAR FLOOD
- 100 YEAR FLOOD
- 50 YEAR FLOOD
- 10 YEAR FLOOD
- STREAM BED
- CROSS SECTION LOCATION

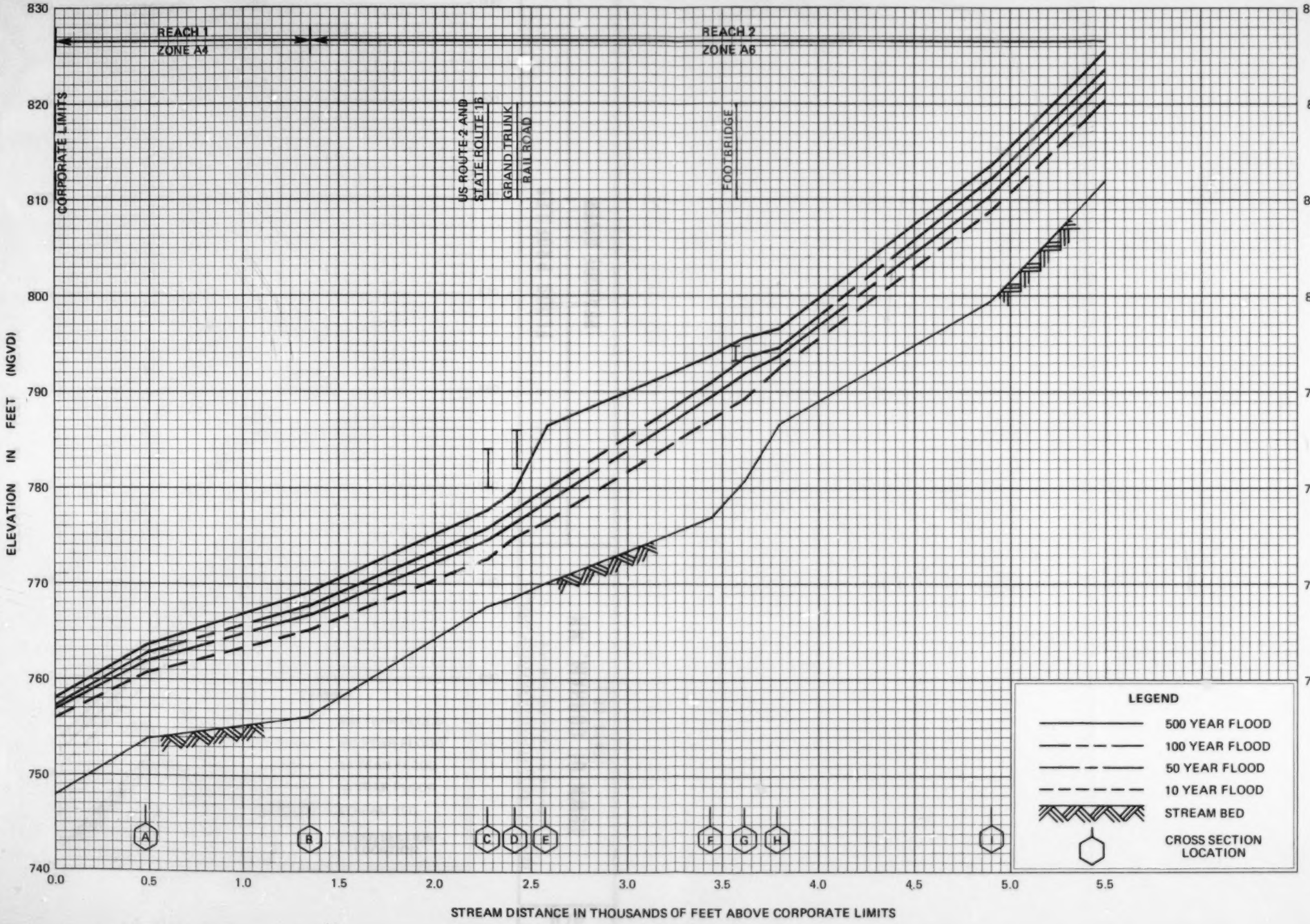
# FLOOD PROFILES

## ANDROSCOGGIN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

## TOWN OF GORHAM, NH
(COOS CO.)

05P




FLOOD PROFILES

PEABODY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

TOWN OF GORHAM, NH
(COOS CO.)

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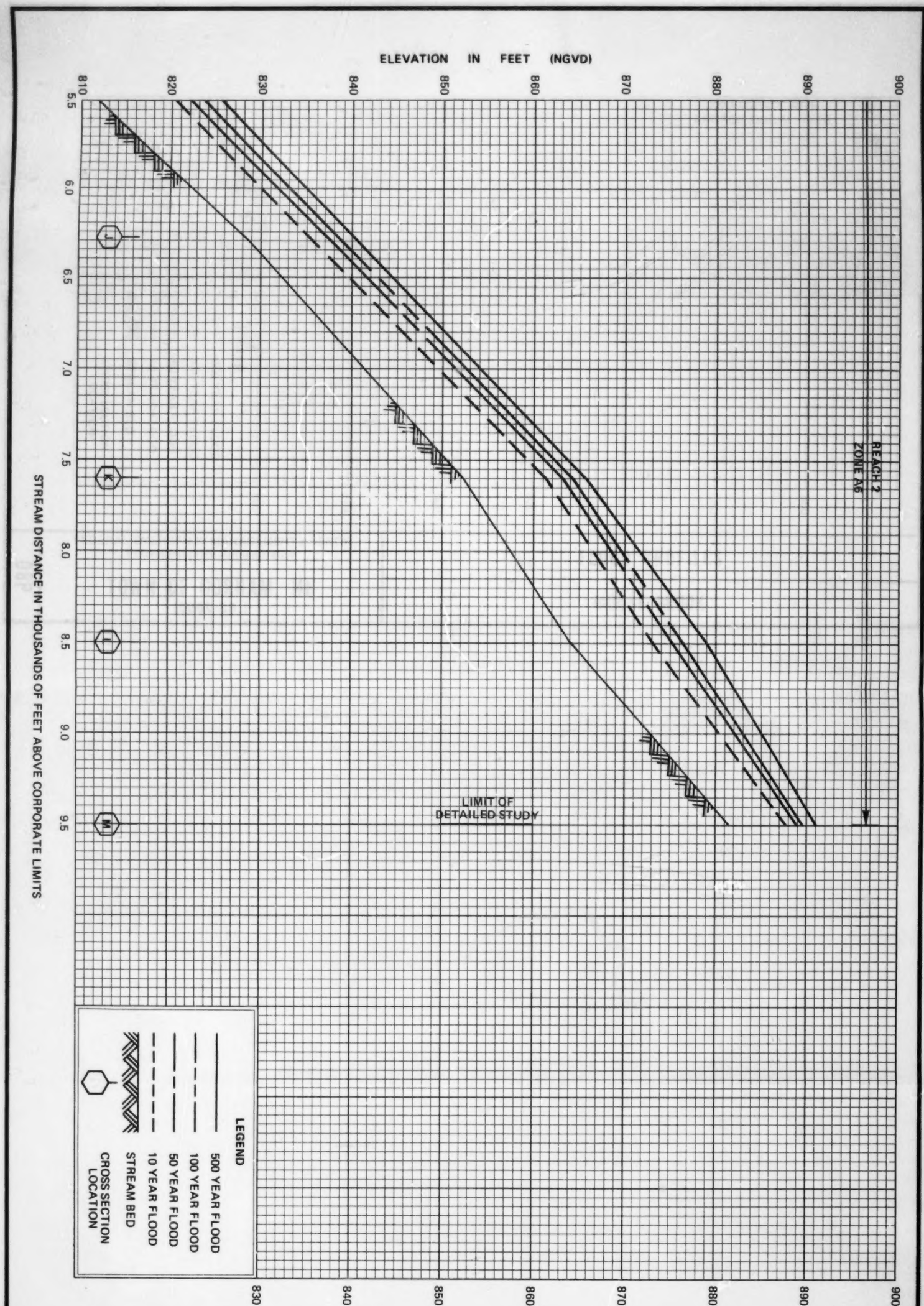


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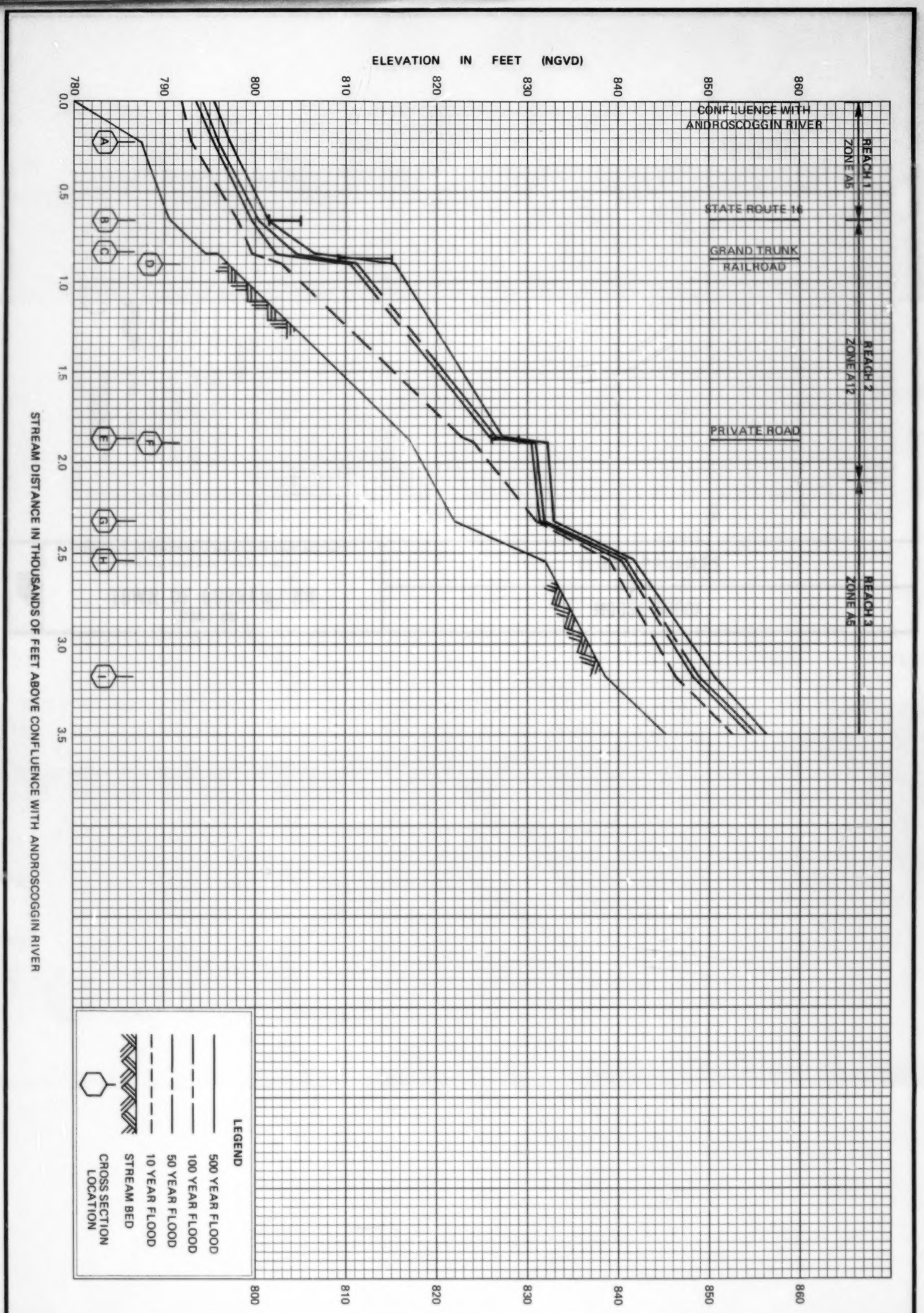
FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

**TOWN OF GORHAM, NH**
(COOS CO.)

**FLOOD PROFILES**

**PEABODY RIVER**

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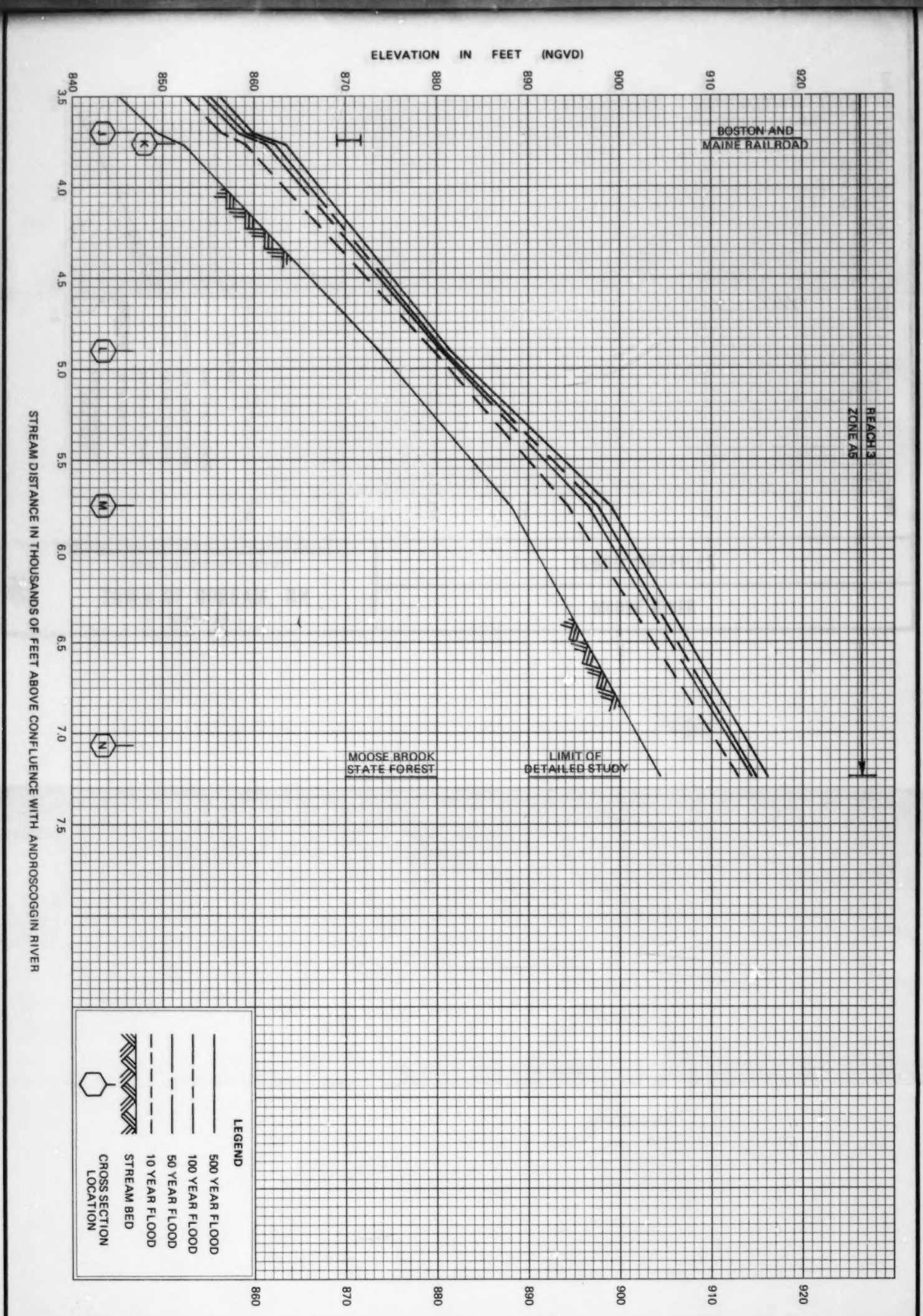
FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

**TOWN OF GORHAM, NH**
**(COOS CO.)**

**FLOOD PROFILES**

**MOOSE BROOK**

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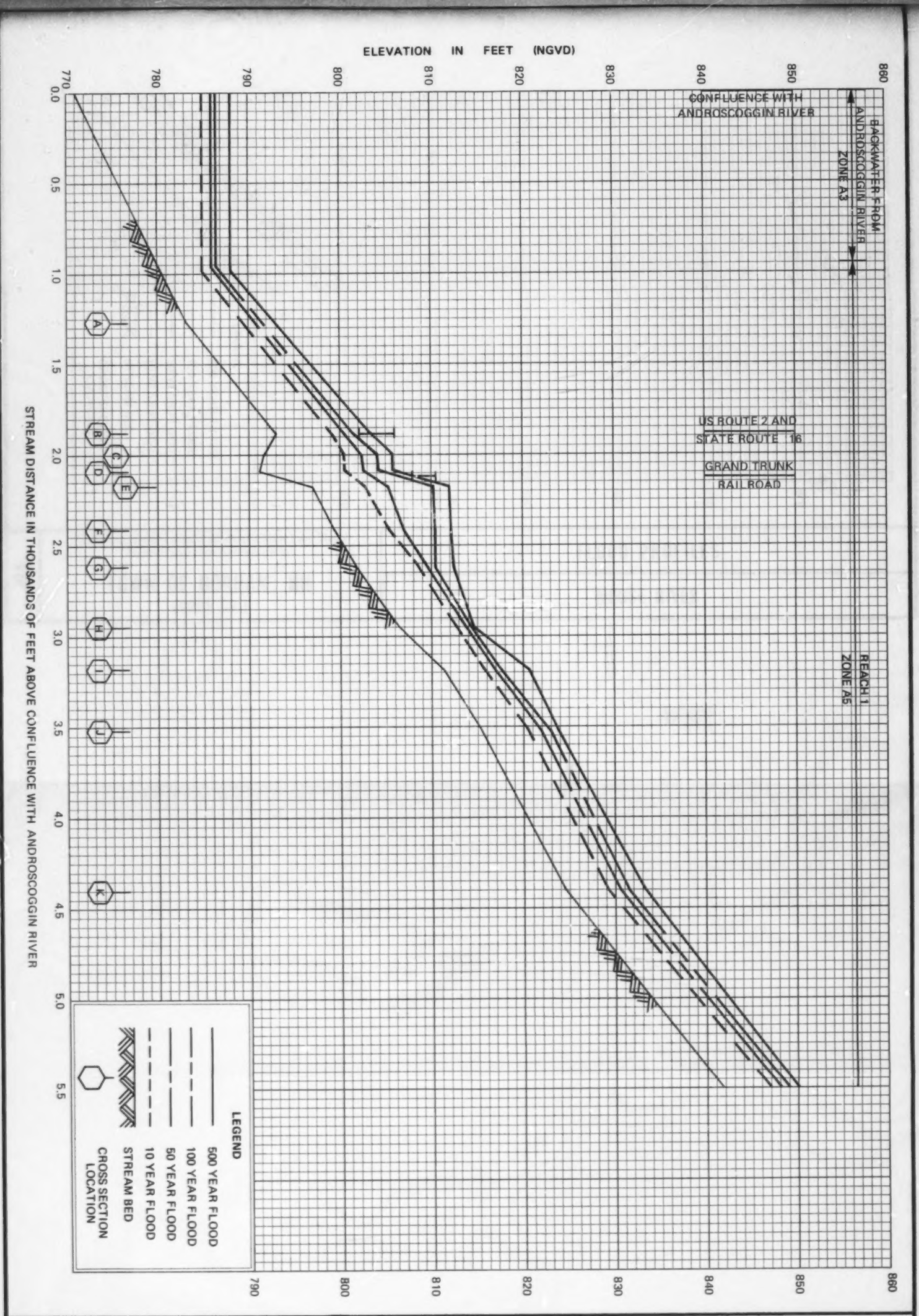


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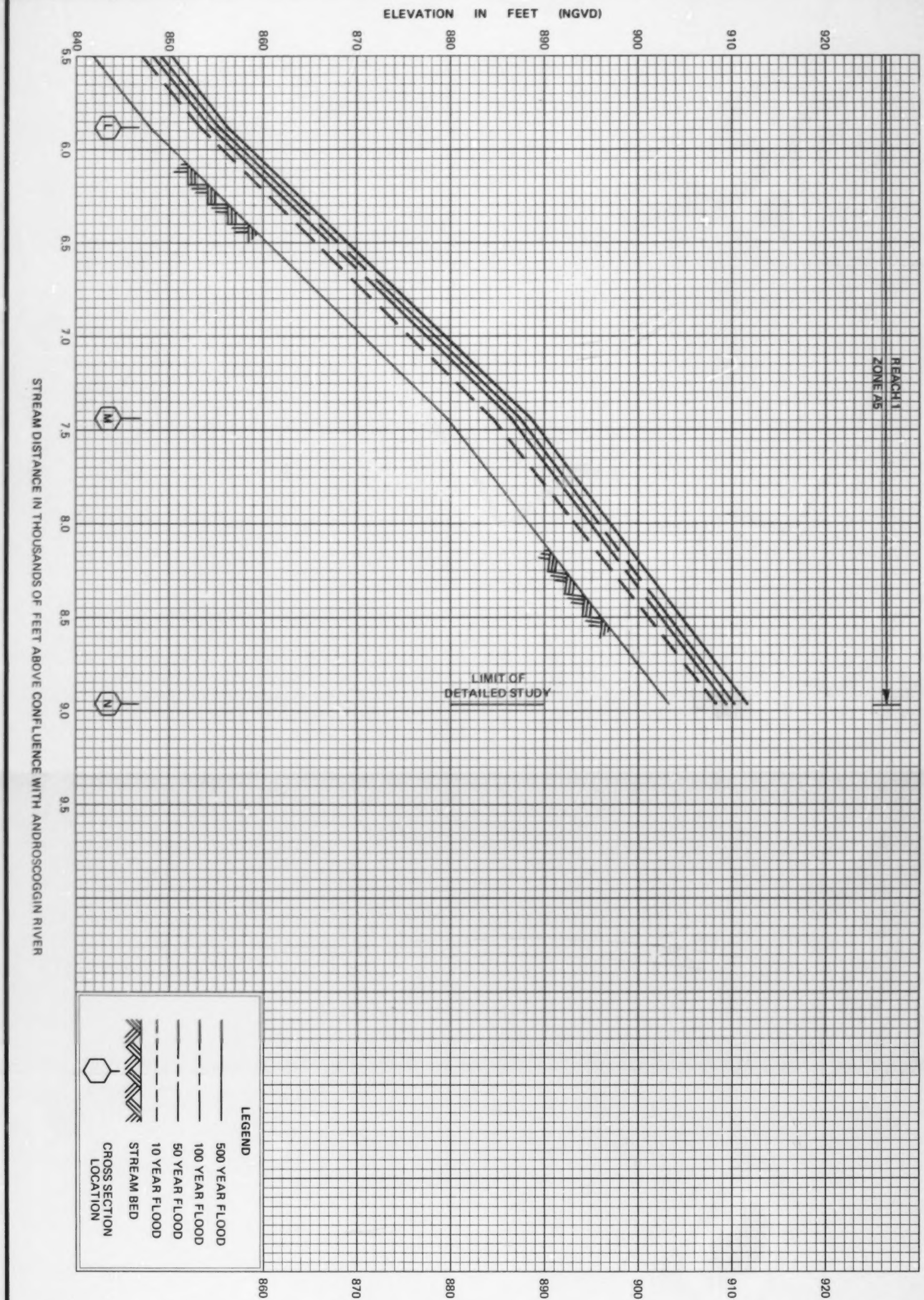
FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

**TOWN OF GORHAM, NH**
(COOS CO.)

**FLOOD PROFILES**

**MOOSE RIVER**

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FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

**TOWN OF GORHAM, NH**
(COOS CO.)

**FLOOD PROFILES**

**MOOSE RIVER**